

NASA ADVISORY COUNCIL

HELIOPHYSICS SUBCOMMITTEE

July 17-18, 2014

NASA Headquarters
Washington, D.C.

Teleconference MEETING MINUTES

Maura Hagan, Chair

Jeffrey Newmark, Executive Secretary

NAC Heliophysics Meeting Minutes, February 27-28, 2012

Table of Contents

Introduction and Announcements	3
Heliophysics Division Update	3

Appendix A- Attendees

Appendix B- Membership roster

Appendix C- Presentations

Appendix D- Agenda

*Prepared by Joan M. Zimmermann
Zantech IT*

July 17, 2014

Welcome and Overview of the Heliophysics Division Status (HPD)

Dr. Jeffrey Newmark, newly appointed interim Director of the Heliophysics Division (HPD), as well as the Executive Secretary of the Heliophysics Subcommittee (HPS), initiated the meeting, and welcomed members to the teleconference, particularly the newest members of the HPS. Dr. Maura Hagan, HPS Chair, opened the meeting officially. New members introduced themselves: Dr. Jill Dahlburg, Naval Research Laboratory, Dr. Neil Murphy, NASA Jet Propulsion Laboratory; Dr. Ralph McNutt, Johns Hopkins University Applied Physics Laboratory; Dr. Spiro Antiochos, NASA Goddard Space Flight Center (GSFC); Dr. Kent Tobiska, Space Environment Technologies. Returning members include Dr. Hagan, National Center for Atmospheric Research; Dr. Jeffrey Hughes, Boston University; and Dr. Mihir Desai, Southwest Research Institute. Ms. Sandra Smalley, the incoming Deputy Director at HPD, was also introduced.

Discussion of Agenda

Dr. Newmark noted that some new subcommittee members had paperwork pending, expected to be completed shortly, and that the goal was also to expand HPS by a few more members in the coming months. Dr. Hagan further described how the HPS served as a conduit between the community and NASA, and reviewed the day's agenda.

HPS Division Overview

Dr. Newmark gave an overview of the latest activities within HPD, first giving new members a brief summary of the NASA Advisory Council (NAC) hierarchy, including how HPS communicates with the Science Committee (SC). Dr. Newmark presented recent science highlights, among which three results stood out: Solar Dynamics Observatory (SDO) observations of the generation of magnetic fields on the Sun; the measurement of interplanetary space weather effects at Mercury; and further data from multiple sources that support the characterization of the current solar maximum as a "mini-max," an historically very low activity level for a solar maximum. Communication and public outreach are ongoing at various levels in the Science Mission Directorate (SMD), while Education and Communications (formerly Education and Public Outreach) at NASA is being re-organized and is evolving. The major objectives of HPD continue unchanged, while an Agency objective has been slightly altered in the language of the Science Plan and NASA's Strategic Plan: this objective now includes language that has added "space weather" in addition to understanding the sun and its interaction with the Earth, the Solar System. The three Heliophysics (HP) goals have also been re-worked. These include: solving fundamental physics, looking at our home in space, building the knowledge and capability to predict extreme conditions in space to protect life and society, and safeguarding human and robotic explorers beyond Earth. The lattermost goal is also a recent change. These changes were vetted through the NAC subcommittees, NASA Roadmapping efforts, and internal activities, and have been accepted at the Agency level. Dr. Hagan remarked that it was important to remember that the role of SMD is to understand the processes behind space weather, and that the HPS had supported including the latest alterations in SMD's documented goals and objectives.

Dr. Tobiska asked about sensitivity to other agencies such as the National Ocean and Atmospheric Administration (NOAA) and the U.S. Air Force (USAF), the customer domain, and how mission statements on “space weather” might be different. Dr. Newmark responded that the key for NASA is building the knowledge to help forecast space weather, and not to actually forecast it. NASA definitely has a hand in developing models and measurement techniques that are essential to forecasting, and is aware of sensitivities to other agencies. Dr. Hughes concurred with Dr. Newmark’s assessment.

Dr. Newmark reviewed some aspects of the HP System Observatory, in which HPD currently operates roughly \$5.5B worth of missions. HPD has adopted a two-year cadence in the performance of Senior Reviews, as has been done in other divisions in SMD. The Magnetospheric Multiscale (MMS) mission will be launching in March 2015. HPD has the requisite budget in place and mission progress looks good. Three of four observatories have gone through thermal vacuum tests, and the stack has gone through vibrational tests. MMS will be measuring magnetic reconnection *in situ* and in real time. The Living With a Star (LWS) mission, Space Environment Testbeds (SET), is scheduled to fly on a Department of Defense (DoD) Defense Meteorological Satellite Program (DMSP) satellite. SET is a series of 4 instruments mounted on a single large deck, which has been in storage for 6-8 years. DMSPs are launched as needed, and the next one will be ready to go about mid-2016. The Solar Probe Plus mission recently went through its Key Decision Point- C (KDP-C) milestone and is set for a July 2018 launch. Much work has been done to retire SPP’s thermal risks; testing of the Faraday cup, operating at 1500°C, went well. The Solar Orbiter (SOC) mission, in collaboration with the European Space Agency (ESA) is committed to a launch date of October 2018. The U.S. is providing 2 instruments and the launch vehicle for SOC. ESA, however, is baselining an earlier launch readiness date of (LRD) of July 2017. NASA will continue to work with ESA on the launch date, although the Agency commitment is to the later date. Two HPD Explorer missions have been selected, ICON and GOLD, each of which will examine the ionosphere. Each mission was selected for its own technical and science merits, and the combined science is considered to be an excellent use of NASA resources. ICON just finished its Preliminary Design Review (PDR), and GOLD will complete PDR soon. Both missions are scheduled for launch in 2017. HPD continues to manage the constantly evolving Sounding Rocket and balloon program for all of SMD. Dr. Antiochos asked how HPD will be handling the Deep Space Climate Observatory (DSCVR mission). Dr. Newmark explained that DSCVR is a NOAA program. NASA’s Joint Agency Satellite Division (JASD) manages this reimbursable program, although DSCVR indeed will include HP science measurements. There is no specific Guest Investigator (GI) funding for DSCVR. Dr. Lika Guhathakurta noted that researchers can always use data for a particular science goal. The LWS supporting research line is open to all data. The Geostationary Operational Environmental Satellite (GOES-R) suite, for instance, is also very relevant for HP science.

There have been two small balloon campaigns in Antarctica, under the mission name BARREL, to study precipitating electrons in synergy with the Van Allen probes. Pictures and data related to BARREL can be accessed at www.nasa.gov/sunearth. Within the HPD research program, as pointed out in the Decadal Survey, NASA remains 100% cognizant of the impact of science. NASA measurements are being converted to breakthrough science. NASA is fully committed to increasing its fraction of funding to research and analysis, and recognizes that the current 9% figure is insufficient to support science

breakthroughs. One must note however, that despite cost constraints, HPD is supporting about 450 awards in total, while trying to improve selection rates. Asked if FY2014 had been a typical year, Dr. Newmark indicated that it was. Dr. Guhathakurta suggested that it is better to pay attention to the total budget, because in terms of supporting people, there are a much larger number than the number of awards indicates.

ROSES 2014 was released in February, having been reorganized to better align with some recommendations of the Decadal Survey; an instrument development program has been added, along with a Grand Challenge research program, which represents larger multidisciplinary centers to support “big science.” Dr. Antiochos, reacting to the statement that “duplicate proposals risk rejection due to noncompliance,” commented that the problem is that one needs several proposals to be fully funded, and asked if HPD had considered increasing grant sizes. Dr. Newmark replied that the division has had these discussions, and has found the HP community to be split on the idea. Without new money, for example, there would be fewer grants if award sizes were to be increased. Asked about the two-step proposal model, Dr. Newmark noted that this approach had been used for the ROSES 2013 GI program, and that HPD was heartened by outcome of the experiment. This year, ROSES 2014 included the Heliophysics Supporting Research (HS-R) element in the two-step proposal model. Those proposals have been received, collated at Headquarters and sent out to the community for mail-in reviews. There were no panels. Roughly half of the previous year’s GI call had been discouraged. This year HPD would like to fund the top-third of proposals, ideally. Unfortunately, the rate has been falling to 1 in 6. Dr. Antiochos commented that the whole community would support the funding for research and analysis (R&A); people are working on too many proposals and too many topics to support themselves. Dr. Newmark noted that the size vs. number of grants problem is expected to be a continuing concern.

The new CubeSat program is very small but exciting, and is demonstrating a powerful new way of going forward. SMD was given a \$5M/year program to be managed by HP on behalf of the directorate. HPD was able to fund 5 new proposals out of this new program, as it had proposals from ROSES13 already in hand; other divisions were not shovel-ready. HPD is excited about demonstrating the technology for science. The National Science Foundation (NSF) and DoD have been flying CubeSats successfully. For NSF, the proposal is typically educational in nature and cost-limited, with about \$900k allotted for the entire proposal, but also accepting higher risk. NASA expects a higher success rate, as in the Sounding Rocket and balloon program (85% success rate, vs. 50% for NSF). Dr. Desai mentioned having had some experience in working with GSFC on CubeSats in 2012, which resulted in some novel instruments for measuring energetic electrons. Dr. Hagan asked if there were a strategy for funding the program going forward: How are the CubeSats evaluated across SMD? Is there a cross-cutting evaluation? Dr. Newmark replied that each division provides funding based on the scientific worth of the proposal, which is evaluated by an interdivision CubeSat panel. Available funds may or may not be distributed equally- the funding will not be provided arbitrarily. Dr. Murphy asked if CubeSats were going to be solicited under the low-cost access to space (LCAS) aegis. Dr. Newmark noted that the approach is still to be determined. For competed PI research, HPD has \$63M/year. If accounting for inflation since 2004, these funds have dropped about 25% in buying power. It is essentially a flat trend. A flat budget and an expanding community have made HPD a victim of its own success.

HPD is currently drafting both vision and mission statements to guide the current program within the recommendations of the Decadal Survey. The Decadal Survey recommended HPD to complete its current program, strengthen R&A, plan for more frequent, lower-cost missions, and implement the DRIVE initiative. Missions of opportunity such as GOLD can be pathfinders in terms of hosted payloads. New money in 2015 was specifically targeted for Solar Probe Plus. HPD will continue to work with the science community both on new funding and allocating more money to R&A. NASA is coordinating with NSF, NOAA, DoD to augment the R&A program, as well. Dr. Hagan commented on the disappointing cadence of the Explorer program- a 5-year cadence is not acceleration and is not in keeping with Decadal Survey recommendations. Dr. Newmark conceded that this was true, but without augmentation, HPD cannot address this issue without an augmentation until the current missions in development launch. If the division takes a long-term view and uses outyear funds, it can allocate for both DRIVE and the Explorer program.

Dr. Newmark reviewed some organizational changes in his new position as interim Heliophysics Director, while Ms. Smalley has recently undertaken the Acting Deputy Director role. HPD has also successfully hired a permanent civil servant at HQ, from APL, Dr. Elsayed Talaat, who is now HPD's ITM Program Scientist. The division is also in the process of moving a new Program Executive, Mr. Joseph Smith, into Dana Brewer's former role. Dr. Hagan asked to be provided an organizational chart listing personnel with their respective roles and responsibilities. Dr. Newmark's position is a one-year term. At some point within the year, there will be an announcement for a permanent director position.

Ethics Training

Mr. Adam Greenstone, a team member of the Office of General Counsel and Ethics Team Lead, provided the HPS its required annual ethics training.

HPD Budget Outlook

Dr. Newmark presented currently available budget information. The FY14 total budget for NASA was \$17.646B, slightly less than the President's request. However, SMD's budget was \$5.15B, or 2.6% more than the request. The money that comes out of SMD and flows through the various divisions is often, for accounting reasons, bookkept in particular divisions. In the Sounding Rocket program, HPD bookkeeps the money, and conversely the balloon program is bookkept by APD, although both APD and HPD use sounding rockets and balloons. Administrative funds are also bookkept similarly. These funds are sometimes misconstrued as extra monies for a division. In 2014, for instance, it appeared the HPD budget had grown by more than \$40M, when this amount really represented an administrative line item. Dr. Hagan noted that the Management Operations Working Groups (MOWGs) are coming out with a finding on this issue. The community is concerned that what goes into the budget request often does not include the administrative line items, which makes the released budget hard to understand. Dr. Newmark displayed HP budgets and projections that clearly delineated the net HPD monies, and noted that there has been real growth, even when accounting for the administrative line items. Dr. Hagan commented that the notional outyear numbers tend to be rather small; the community is not seeing this level of budget detail so they are confused about getting "extra money" in the President's budget. HPS is spending too much

time explaining this to the community. Dr. Newmark observed that in point of fact, 10% of the HPD budget goes to the competed PI-led research program, and 90% goes to missions.

Dr. Newmark presented a series of President's budget requests over time, reflecting HPD's annual budget trend, with the administrative line items removed. As NASA moves from 2016-2018, the numbers are all trending better than they have in the past. It is important to note the effect of sequestration, the recession, and continuing nationwide and global issues. There is some small growth from 2014-15. Dr. Newmark emphasized that the big question over the last few years has been how much is Solar Probe Plus (SPP) is going to cost. There had been much anxiety about cost growth about this mission. However, according to the 70% Joint Confidence Level (JCL) analysis, a real number of \$1.5B has been obtained. Ms. Smalley confirmed the cost at \$1.553.4K, including the cost of the launch vehicle. SPP is the largest mission ever for HPD. Meanwhile the division is maintaining the development and implementation of Solar Orbiter, MMS, ICON and GOLD, and is looking forward to implementing DRIVE. Dr. Antiochos commented that it was quite impressive that the mission builders have kept the mission at cost. Dr. Newmark agreed, extending kudos to everyone at NASA. He added that between today and 2018, HPD will be launching \$3B worth of missions, an extraordinary number for SMD's smallest division. Many of the newest Decadal Survey recommendations will have to be shifted to the right however. The division can't increase the Explorer cadence or start its next strategic mission until these missions launch.

Dr. Antiochos commented that there is no point in having \$3B worth of hardware if there is no science community to provide investigations and interpretation. Dr. Newmark responded that the intention is to match up the discrepancy, as the issues are driven by the budget. HPD is attempting to rectify the matter through long-term planning, and distributing the budget between research programs and a balanced mission portfolio.

HPS Discussion

Dr. Hagan asked members to bring issues to the table for discussion. Dr. Antiochos asked if there had been any discussions with NSF or the Department of Energy (DOE) on the establishment of interagency science centers. Dr. Newmark replied in the affirmative for NSF, which is strongly in favor of the idea. There was general agreement among the HPS that the community might want to consider forming a committee to determine the best way to charter the science centers. Dr. Tobiska asked if NASA had contacted organizations such as Virgin Galactic and Worldview for CubeSat-class efforts. Dr. Newmark noted that for the last 2-3 years, as part of LCAS, HP has offered commercial launches as an option; this is now called Suborbital Reusable Launch Vehicles and is available for all the divisions in SMD. A proposer can put an instrument on XCOR Lynx, for example. These proposals are scientifically competed against rockets and balloons (\$0.5M to \$3M for a total project). NASA has not funded any of these proposals as yet, but they are available. Dr. Tobiska noted that the community is very excited to be participating in these types of payloads. Dr. Murphy asked if HPD has considered how elements of the Explorer program can be transitioned to CubeSats. Dr. Newmark felt that there were innovative and flexible ways to do science; the Roadmap has targeted standardized small buses for this purpose. The way the HP discipline could be successful is to look at Decadal Survey science and carry it out in a cheaper, distributed system. Small satellites are intrinsically about distributed systems. Dr. Murphy suggested that there be language included in the Explorer call that might enable/encourage this type of thinking; if

NPR7120.5 governs CubeSats, they will eventually cost as much as the Shuttle program. Ms. Smalley added that at the Agency level, there is a new sensitivity to avoid overburdening smaller projects; NASA recognizes that there is not a one-size fits all solution and is undertaking an effort to address it. The current policy is actually NPR7120.8 applies to CubeSats, similar to sounding rockets and balloons. In response to a question, Dr. Newmark responded that SPP has the phase E budget that the PIs agreed to at confirmation. Dr. Hagan asked if all the step-1 proposals in the current Heliophysics Supporting Research (HP-SR) competition were complete. Dr. Newmark replied that one of the categories had been slightly delayed due to the recent changes in the HPD organization, and that the division had just put out an amendment on the solar category, which will be delayed by about 6 weeks. The delay in the deadline will not affect the step 2 timelines for the other proposals, and the other 3 areas may be selected ahead of schedule.

July 18, 2014

Overview of Agenda

Dr. Newmark opened the meeting and called the roll. Dr. Hagan welcomed members and reviewed some minor changes in the agenda, including a joint presentation of the Solar/Heliophysics and Geospace MOWGs. Dr. Hagan appointed Dr. Antiochos as acting chair for the day, owing to her impending absence during the morning. The subcommittee planned its next meeting date for the month of September. For new members, Dr. Newmark enumerated the duties of the HPS as they relate to the Government Performance and Results Modernization Act (GPRMA), which will entail a collection of key science results from both NASA and the community, so as to illustrate how HPD has met its performance metrics for the year.

Flight Status Report

Ms. Smalley provided an overview of the HPD flight program, showing that the portfolio is fairly balanced among the major line items. Major launch events are on schedule. DFS has been deferred to 22 July. The Peregrine rocket will undergo burst testing shortly, followed by its first flight test in the fall. In terms of program performance, most missions are green; MMS is red but will be changing. The red grade reflects hits taken during sequestration last fall. A Directorate Program Management Council (DPMC) approved an MMS re-plan recently, and HPD anticipates that MMS will be back on track very soon. There have been some issues with the navigation boards, however the problem has a known fix and a root cause has been identified. One of 4 observatories is complete, and the program should be green by next month. Observatory 3 is in thermal-vacuum testing, which is going well. MMS has 304 opto-couplers; these units are an industry-wide concern and will be a watch item until the mission launches. STEREO is in extended operations and is providing good science, but as its antenna points closer to the sun due to the sun-Earth angle, it is heating up higher than anticipated, thus the mission will have to shut down some instruments during a period of maximum heating. Conjunction testing is in progress to ensure that the instruments can re-start after the shutdown. RHESSI, which has been operating for over 12 years, is undergoing a fourth detector annealing process to address expected degradation. RHESSI continues to do well, beyond its mission lifetime. Significant accomplishments include MMS shipping to its launch site in

the Fall, and SPP transitioning from Formulation into Implementation in May of this year. ICON will go to KDP-C on 26 August, and GOLD is scheduled for PDR in October. There will be a program implementation review (PIR) for Explorer, LWS, and STP in mid-October. Ms. Smalley elaborated on the function of the PIR as an opportunity to determine whether program offices are functioning effectively and in compliance with Agency policy. The last PIR was roughly 5 years ago.

The current operating mission suite includes 18 projects, 15 of which are in extended operations, and 3 in prime. TIMED has just learned of a potential conjunction due to a space debris alert; the debris is being tracked. CLUSTER mission support is ending from the mission perspective. Asked about IRIS ASF issues, Ms. Smalley reported that antenna issues in Alaska have been resolved. The NASA Earth Network had switched an antenna and lost 2 orbits of data, out of multiple orbits per day. The SDO-EVE sensor MEGS-A, which provides short wavelength coverage, is not functioning. The problem doesn't look fixable, but there may be some possible work-arounds. MEGS-B is still operating, and there is some wavelength overlap. ESP is operating as well.

Ms. Smalley elaborated on upcoming plans for protecting STEREO's high-gain antenna as it moves closer to the sun. Current testing is under way for the AHEAD spacecraft; BEHIND will be tested in October. As STEREO gets closer to superior conjunction, AHEAD will be turned off from August 2014 to December 2015, and BEHIND from November 2014 to January 2016. There will be reduced science data output during these periods. Dr. Hagan expressed appreciation for keeping the community apprised of these issues.

At the Wallops Research Range, recent activity includes the launch of CHESS on 24 May, which performed successful observations of the local interstellar medium. CHESS was an Astrophysics mission with HP relevance (their noise is HPD's signal). The SubTec-6 rocket failed and was destroyed in flight. The education activity RockOn-VII was successful, and an International Space Station (ISS) cargo ship was successfully launched on an Antares rocket on 13 July. Asked if the Wallops range was adequately supported, Dr. Newmark responded that the Sounding Rocket Program Office receives about a \$50M/year to support the various ranges such as White Sands and Poker Flats; however that budget has been flat for a decade and is under stress. The outyear budgets may not be able to support the flight rate and remote campaigns as it is currently done. Dr. Hagan commented that this implies that the selection rate for LCAS will be impacted. Dr. Newmark felt that this would not be a direct correspondence, but rather related to long-term flat budgets and inflation. Dr. Antiochos noted that launch rates and science return were decreasing in terms of supporting PIs and facilities. Dr. Newmark agreed, and added that remote campaigns are also being affected (Australia, Kwajalein, etc.). Asked who was in charge of Sounding Rockets at HQ, Dr. Newmark reported that he was the Sounding Rockets Program Scientist, and Cheryl Yuhas, who is transitioning off, was the Program Executive (PE). George Albright is transitioning on as the new PE. There had been a recommendation to have an SMD suborbital coordinator to oversee all the suborbital programs- balloons, Earth airborne, etc. A new person has just been selected as this permanent coordinator, (the name is not public yet). The coordinator will be starting by the time of the next HPS meeting.

Dr. Tobiskas asked if piggyback flights were possible. Dr. Newmark replied that they were possible but rare. One is permitted to approach a PI running the primary experiment, and while NASA is not

enthusiastic about forcing these collaborations, it is willing to put them through peer review. Dr. Tobiska felt that such flights do not represent a huge cost to the program, and that the community could make advances in this way. Dr. Newmark invited him to write up a one-pager on the subject.

Roadmap Status Report

Dr. Ed Deluca provided a status on the Heliophysics Roadmap Committee, which is charged with reviewing Decadal Survey recommendations. Incorrect budget assumptions and changes in leadership caused some delays on final reporting. The goal of the Roadmap is to implement the Decadal Survey recommendations in an atmosphere of budget constraint, complete the existing program, implement the NASA components of DRIVE, grow the Explorer program as recommended by the Decadal Survey, and to evolve the HP budget to increase the emphasis on grants programs and the Explorer/MoOs. One of the challenging issues is the drawn-out nature of the strategic flight program, thus it is felt that HPD must develop Smallsat/CubeSat technology to achieve important science measurements, address the order and size of the strategic missions, and identify a way to obtain continuing measurements that are critical to the interpretation and analysis of new mission data (perhaps through SmallSat technology).

Final edits on the Roadmap are currently being made by the HPD. Dr. Newmark noted that the final document had been delivered to the division about 6 months ago. The HPS has approved the current version of the Roadmap, and has returned it to HPD for editorial work. Word editing is essentially done, and the document is now being formatted, and anticipated to be posted on the web within a week or two. The online version will probably not be available for the NAC Science Committee at the end of the month. Asked when the next Roadmap was due, Dr. Newmark that the next Roadmap would be initiated in early 2017, in advance of the 2018 timeframe of the NASA Strategic and Science Plans. Dr. Deluca suggested planning for the Roadmap exercise 18 months in advance.

Dr. Deluca reiterated concerns over administrative line items in the HPD budget and the community's perception of research reality. He noted that the MoO program seems to have been absorbed into the Explorer program, and that the next Roadmap should address these issues. Dr. Antiochos expressed concern over the fact that the DRIVE initiative does not exist in any real budget.

Dr. Hagan signed off at 11:20am, and Dr. Antiochos took over as Chair for the interim.

Dr. Deluca discussed programmatic balance, noting that the Roadmap committee did not agree with the pushing out of the STP and LWS missions. If more than a decade elapses between launches, there is no LWS. HPD needs to do strategic missions at costs considerably less than that assumed in the Decadal Survey. It is now the community's charge to implement strategic missions at a cost of less than \$1B per mission. Dr. Antiochos remarked that it is clear that the community should do more science through small flexible missions, and asked if any studies had been carried out to identify such notional missions. Dr. Deluca reported some strong consensus in the community for spending money on instrumentation, and even on low-cost launch vehicles. There needs to be a mindset change, such as risking a \$35M instrument package on a total mission cost of \$50M. Dr. Dahlburg remarked that there is an assumption that a small cheap platform will require perhaps 7-10 years to reach an acceptable maturity level. Dr. Murphy

commented that in the CubeSat world, it is difficult to get the same CubeSat each time. The community should be focused on achieving applications instead. The timescale to launch for a CubeSat is a couple of years. Dr. Dahlburg felt that the HPD should concentrate on developing on a reliable platform, which may require a different technology development plan than is currently in place. Dr. Tobiska asked if it were known whether other agencies were proceeding with similar implementation levels on the DRIVE initiative. Dr. Newmark noted that NSF is actively working their part of the DRIVE initiative, while NASA has already begun its interagency activities with NSF.

LWS Steering Committee Report

Dr. Nathan Schwadron presented a report on the 2013 LWS Targeted Research and Technology (TR&T) Steering Committee. The committee was tasked with developing new focus topics, which in turn helped to inform the LWS solicitation in 2014. The goal was to provide a top-level, 10-year vision for the next LWS program. Overall, the committee felt that LWS has been performing well, but that it was now time to expand the original model to make it more multi-disciplinary; this philosophy is well in line with the DRIVE initiative. The LWS Strategic Plan group has had 3 face-to-face meetings, and its draft plan is roughly 2/3 complete. There is a recognition that LWS needs to evolve more rapidly to prototype science-based tools, diversify platforms, engage in international, interagency, and interdivision partnerships, as well as to engage partners in industry, share launches, and diversify utilization of ground-based assets. LWS should maintain a connection to DRIVE in seeking new pathways from research to space weather forecasting, establishing metrics and assessment tools, large-scale computing efforts, and LWS science centers.

A major take-home message from the Steering Committee is that LWS as a whole cannot be fundamentally focused on large missions; the program must adapt so that it can fill in gaps in observations, as assets retire. Dr. Antiochos asked how the National Oceanic and Atmospheric Administration (NOAA) has been interacting with LWS. Dr. Guhathakurta responded that NOAA has worked very well with the TR&T program, with a fully engaged NOAA representative participating in each focused study topic (FST). She felt that there could be better coordination and stronger interaction with NOAA's satellite division, the National Environmental Satellite, Data, and Information Service (NESDIS), but that NASA was continuing its work with NOAA on their mission side to derive LWS science. LWS modeling needs L1 data that NOAA can provide, for instance. HPD is keeping LWS focused on science with relevance for society, but this focus allows discussion of the science benefits for LWS. NASA is open to input from all, but NASA currently does not have a lot of input into NOAA missions. Dr. Schwadron observed that while it is very unclear how both communities operate, it is clear that NASA and NOAA must work together or else the science community will suffer. To achieve big mission science with fewer resources, a new vision must be developed to allow researchers to try things out and see how they work, try different assets, and keep an open mind on how to carry out the necessary measurements. Dr. Newmark suggested considering the ISS for trying out new technologies, through CubeSat-like experiments; ISS can be a cost-effective platform for HPS when appropriate. NASA would also benefit from a closer relationship and cross-pollination with DoD, particularly for access to space. Dr. Dahlburg noted that the DoD Space Test Program is funded at \$26M per year and is widely used. Dr. Schwadron felt it should be strongly emphasized that LWS has a fundamental need to fill in gaps for future, and he didn't see the mechanisms in place to develop this capability- there is no LWS

Management Operations Working Group (MOWG), for instance. Dr. Guhathakurta agreed that the disbanding of the LWS MOWG has left a hole in the program. Dr. Schwadron added that the LWS role in the DRIVE initiative has yet to be defined. Dr. Tobiska mentioned that a space weather workshop held in April of this year generated interest from NSF, as well as a lot of interest across the board that could be broadly leveraged. There is also the atmospheric drag issue that has not had much science put into it. There are some potential partnerships there.

Solar/Heliosphere MOWG Report/Geospace MOWG Report

Drs. James Klimchuk and Doug Rowland reported on the MOWGs. Dr. Rowland reported on two important joint findings of the GMOWG and SHMOWG. The MOWGs met early 2014 and focused mainly on the Heliophysics R&A budget. There were several GMOWG findings on proposed changes in the MMS mission and their impact on research, NASA's role in space weather forecasting, investment in the CubeSat program, and ongoing concerns with NASA's Education program.

Dr. Klimchuk focused on the SHMOWG finding decrying a 26% reduction in R&A funding since 2004, and applauded HPD's decision to redress the issue, as it is consistent with the Decadal Survey. The SHMOWG also applauded the HPD's intent to contribute 2% of the estimated total cost of future missions to the GI program. He further encouraged the HPD to rebalance its goals as soon as possible. In contrast to other divisions, HPD is way behind in the fraction of its budget that is devoted to R&A- HPD is at 10%, while other divisions are closer to 20%.

Dr. Rowland addressed a chart on real-year dollars devoted Heliophysics Research funding, noting that there is a huge threat to future scientist tracks that could be addressed by HPD increasing R&A by \$10M/year. Dr. Newmark asked how HPD might allocate this amount: Put it in the Senior Review program? technology development? science centers? Dr. Rowland felt that every aspect of the research program was under threat. Dr. Klimchuk recommended restoring the grants program as a top priority. Dr. Antiochos that his personal sense was that there was more concern about the success rates of the existing program.

GMOWG Finding 2 concerned the need for more transparency in HPD budget reporting, particularly in terms of specifying Administrative and DR&T line items and their impact on the research budget. The finding specifically states that it would be beneficial to keep reporting the line items transparently, so that the community can track them from year to year, as HPD has been doing. Dr. Rowland thanked Dr. Newmark and Dr. Arik Posner for tracking these items, and suggested that the name of the line item be changed from "Heliophysics Research" to "Heliophysics Research and Infrastructure." Dr. Newmark took the suggestion forward as an action item, but noted for the record that the online budget is already displayed to the recommended level of detail.

Finding 3 concerned the orbital changes in the MMS and Themis missions. Dr. Newmark noted that NASA had carried out a study on the orbit change and has proceeded to orient the spacecraft at 180 degrees from one another; there is still active coordination between the two missions.

Finding 4 called for an enhancement and strengthening of the collaboration within NASA and between NASA and other agencies, NOAA, NSF and DoD. The GMOWG recommended an IPA exchange program, with a focus on space weather science research and research-to-operations work. Two of the 4 findings are already in place. Dr. Elsayed Talaat added that there are now two active working groups, one between HPD and NESDIS, and the other between the NASA Community Coordinated Modeling Center (CCMC) and the NOAA Space Weather Prediction Center (SWPC). There are also different subgroups working on implementation plans of the National Space Weather Council; the HPD Division Director is on that council. Dr. Guhathakurta noted that the Committee on Space Weather (CSW), comprised of chairs from NASA, NOAA, NSF and DoD, is where some critical work goes on somewhat organically. Dr. Dahlburg observed that CSW is a great forum that lacks money, adding that space weather has very few clear examples that can convince people that it is worthy of investment.

Finding 5 supported the importance of CubeSats to Heliophysics science, while noting that the program is in its infancy. Dr. Newmark reported that there are 5 new HP CubeSats, and that it is also important to start tracking their science results to keep abreast of NASA's return-on-investment. The GMOWG also urged NASA to protect its highly successful balloon/rocket program as it provides critical mass for science, and strongly recommended a "porous fence" program wherein sounding rockets are mostly protected. HPS briefly discussed the utility of sounding rockets, particularly in that they deliver data that cannot be observed from satellites (ionosphere/mesosphere for *in situ* measurements). Sounding rockets also support technology demonstrations, as for CubeSats. CubeSats are not a panacea however. Dr. Newmark explained that as a general rule, HPD evaluates LCAS primarily for science return, followed by technology development, and the training of future PIs. CubeSats are also selected on the basis of science return.

Finding 6 suggests that NASA find ways to enhance Public Outreach for NASA science, such as providing a non-monetary journalism awards program for the best news article about Heliophysics research, journalism fellowships, and "boot camps" for early-career scientists. Ms. Jenny Rumburg noted that NASA already provides media training to staff to enhance communication of science results to the public, and also encourages scientists to bring results to NASA in order to help develop media products to raise general awareness. While Ms. Rumburg felt that the finding contained many good recommendations, she wanted to raise awareness of what is available at NASA in terms of communications.

Dr. Klimchuk elaborated on the SHMOWG finding on HPD exploring ways for other countries and other US agencies to be major partners in future missions, beyond simple instrument contributions. Partnerships such as that pursued during the Hinode mission are encouraged. Dr. Newmark noted that for the Mars 2020 mission Announcement of Opportunity (AO), NASA accepted full instruments from any participant, and that all LWS competitions are similarly open. Dr. Klimchuk asked if there were ways to encourage foreign partners to be more successful. Dr. Guhathakurta cited Solar Orbiter as an exemplar, as it was competed collaboratively between NASA and ESA, with coordinated budgets, memoranda of understanding (MOUs) and joint science definition teams (SDTs), similar to how the James Webb Space Telescope (JWST) was competed. To make this happen more frequently and encourage foreign entities to be bigger partners, Dr. Guhathakurta suggested having a well-defined payload upfront, as this better enables a decision as to who contributes what. Dr. McNutt noted that there is a German camera on the DAWN

mission, and that the Mars InSight payload is coming from Italy and Germany. There is now a limitation on how much foreign contribution can be made, however; this is a different problem. The Europeans have certainly brought entire instruments to NASA missions. Dr. Dahlburg mentioned that the Japanese Solar-C mission has elicited much interest from NASA and ESA, because the mission is being carefully planned ahead of time. The HPS discussed potential contributions from the commercial sector, where there is a strong interest in focused topics particularly. Dr. Tobiska cited the example of a United States Geological Service (USGS) magnetometer having been placed on a commercial oil drill bit. There was general agreement that commercial participation would be welcome. Dr. Newmark noted that thus far, NASA has not directly approached companies, but have left this option to the PIs. The MoO GOLD, e.g. will be flying a spectrometer on a communications satellite to take ionospheric measurements.

Discussion

HPS began a general discussion and considered findings and recommendations. Dr. Murphy suggested a further consideration of Finding 5 from the GMOWG, concerning a “porous fence” approach to the Sounding Rocket program, while remarking that more opportunities rather than restricted funding would be the goal of such an approach. Dr. Antiochos felt that HPD would need more funds if it were to implement the porous fence approach. Dr. Tobiska asked if CubeSats were being solicited separately from the DRIVE funding line. Dr. Newmark replied that DRIVE is not a monolithic funding line, but a concept, and that CubeSats do fit in with the idea of DRIVE. This does not, however, imply extra funding. It is also important to note that DRIVE does not currently exist; it is a series of initiatives that would eventually put about \$40M/year toward the GI program, science centers, technology, cubesats, and competed research. Dr. Tobiska commented that there seemed to be two strategies for funding research: one is reallocation between existing lines, and the other is figuring out ways to grow the pot, leveraging, etc. How should HPS handle these issues? Dr. Newmark noted that any ideas were welcome. Dr. Tobiska suggested experimenting with approaches over the next year, to see if there is one area where capability can be grown without funding. Dr. Antiochos felt that more concrete ideas would be helpful; HPS took the discussion offline and agreed to return to the topic.

Dr. Murphy shared a recent result on contact with the ISEE-3/ICE spacecraft, and described a plan whereby the magnetometer might be placed into an L1 orbit, where it might be able to contact present assets. Ms. Rumburg noted that there is no detectable pressure in the spacecraft fuel tanks, making an orbital insertion impossible, but added that communication will continue. NASA has signed a Space Act Agreement with SkyCorp that will allow data to be publicly available. Dr. Newmark encouraged HPS to send science highlights for Dr. Hagan to present at the upcoming Science Committee meeting and took an action to send his own results to the full HPS.

Findings

Dr. Antiochos felt that the joint SHMOWG/GMOWG finding on international partnerships was a top finding. Dr. Guhathakurta noted that there is already a mechanism in place within LWS for facilitating

international partnerships, which paved the way for Solar Orbiter and the Chinese mission Kua Fu. LWS can put together a joint science team and write an AO in a way that allows anyone to propose a mission as long as the science case is compelling. Another way to move forward would be to look at other agencies' portfolios and aggressively pursue new opportunities at the Division Director level. Members discussed the importance of the international element of the Cassini/Huygens mission, crediting international support with keeping the mission from cancellation at several points in time. Dr. Newmark suggested that HPS perhaps remind the community, in a letter format, that the AOs are open to everyone. Dr. Antiochos felt that a finding that goes to the division would support a more proactive effort to generate foreign partners. Dr. Murphy suggested folding in the travel curtailment issue to make this point.

HPS briefly considered a travel finding to bring to the NAC. Dr. Dahlburg noted that restrictions on travel were preventing missions from nucleating. Travel constraints have been a general obstacle to science. Dr. Murphy observed that travel restrictions also hinder the ability to hire young people. Drs. Antiochos, Dahlburg, and McNutt agreed to compose a finding, and deferred a finding on joint SDTs to a future meeting.

Dr. Tobiska suggested a public outreach finding, in that Education/Public Outreach (now termed Education and Communications; E&C) does not address professional education nor the participation of the community in standards development. As these two latter components help to create a science/engineering foundation, HPS might want to mention this while discussing E&C activities in future discussions.

HPS concurred that there were no other findings to be raised to the NAC level.

Public session

The meeting was opened for public comment. Dr. Vassilis Angelopoulos posed a question on implementation of low-cost missions in the mid-sized category, as there are now interfaces between payloads and upper stages that can enable mid-size missions- how can we bring this awareness to the community? Dr. Newmark felt this information could be included as information in future AOs, and also reminded the community to consider ISS for similar ideas.

Wrap-up/findings

Dr. Newmark reviewed potential agenda items for the next HPS meeting: GPRAMA; LCAS and CubeSats and the interaction between them; status of the LCAS program; international and interagency partnerships; Solar-C presentation; National Space Weather Implementation Plan briefing; draft Space Weather Roadmap. Dr. Antiochos adjourned the meeting at 3:05 pm.

Appendix A Attendees

HPS Committee members

Maura Hagan, Chair, National Center for Atmospheric Research
Spiro Antiochos, NASA Goddard Space Flight Center
Jill Dahlburg, Naval Research Laboratory
Mehir Desai, Southwest Research Institute
James Klimchuk, NASA Goddard Space Flight Center
Jeffrey Hughes, Boston University
Ralph McNutt, Johns Hopkins University
Neil Murphy, NASA Jet Propulsion Laboratory
W. Kent Tobiska, Space Environment Technology
Jeffrey Newmark, Executive Secretary, NASA SMD

Headquarters

Elaine Denning, NASA HQ
T. Jens Feeley, NASA HQ
Lika Guhathakurta, NASA HQ
Jeffrey Newmark, NASA HQ
Jenny Rumburg, NASA HQ
Sandra Smalley, NASA HQ
ElSayed Talaat, NASA HQ

Webex

Vassilis Angelopolous, UCLA
Art Charo, National Research Council
Ed Deluca, Harvard University
Grace Hu, Office of Management and Budget
Tricia Johnson, NASA SMD
Mona Kessel, NASA HQ
James Klimchuk, NASA GSFC
Kelley Korreck, Smithsonian
Dan Leone, Space News
James Lochner, USRA
David Milman
William Patterson, NASA
Douglas Rowland, NASA Goddard Space Flight Center
Nathan Schwadron, Boston University
Dennis Socker, Naval Research Laboratory
Marcia Smith, Spacepolicyonline.com
Jeffrey Stehr, NASA
Steve Thompson, Millennium Systems
Mark Zasrow, Nature Magazine
Joan Zimmermann, Zantech IT

Appendix B
Subcommittee Membership

Maura Hagan, Chair
National Center for Atmospheric Research

Spiro Antiochos
NASA Goddard Space Flight Center

Jill Dahlburg
Naval Research Laboratory

Mehir Desai
Southwest Research Institute

James Klimchuk
NASA Goddard Space Flight Center

Jeffrey Hughes
Boston University

Ralph McNutt
Johns Hopkins University

Neil Murphy
NASA Jet Propulsion Laboratory

W. Kent Tobiska
Space Environment Technology

Jeffrey Newmark
Executive Secretary
NASA Headquarters

Appendix C Presentations

1. Heliophysics Division Overview; *Jeffrey Newmark*
2. Heliophysics Division Budget Outlook; *Jeffrey Newmark*
3. Heliophysics Division Flight Status Report; *Sandra Smalley*
4. Heliophysics Roadmap Status Report; *Edward Deluca*
5. Living With a Star Steering Committee Report; *Nathan Schwadron*
6. Solar/Heliosphere and Geospace MOWG Joint Report; *James Klimchuk, Douglas Rowland*

Appendix D

Agenda

Heliophysics Subcommittee Meeting Agenda 2012 February 27-28

Monday, February 27 – Room 8R40

- 9:00 Welcome, agenda overview, logistics, introductions
- 9:15 Heliophysics Division Directors Update
- 10:00 Flight Mission Status Report, Division Deputy Director
- 10:30 Discussion
- 10:15 BREAK
- 11:00 Heliophysics Division Data and Computing Policy and E/PO Update
- 11:20 SMD E/PO Status Report 11:30 Discussion: Subcommittee Recommendation
- Noon Lunch in Room: The Latest IBEX Science Eric Christian, NASA/GSFC
- 1:00 Annual Ethics Training
- 2:00 Chief Scientist Report
- 2:30 Discussion
- 2:45 Break
- 3:00 Discussion
- 3:45 Mission Briefing: DSCOVR
- 4:15 The Heliophysics Decadal Survey: Preparation for its delivery and the methods by which the recommendations are incorporated into the 2013 SMD Science Plan
- 4:45 Discussion

END OF DAY

Tuesday, February 28 – Room 8R40

- 9:00 Heliophysics Research and Analysis Programs
- 9:45 Management Working Group Reports (15 minutes each) Joint SH & G MOWG
Geospace MOWG Solar & Heliosphere MOWG
- 10:45 SMD Associate Administrator Remarks
- 11:15 Discussion
- 11:30 Space Weather: what does it cost and how bad can it get?
- 1:00 Meeting Briefing: European Commission November 2011 meeting on the societal consequences of space weather.
- 1:30 Update: NASA's Space Weather Working Group
- 2:00 Next meeting planning; review of actions
- 2:30 Break
- 2:45 Discussion
- 5:00 Debrief with Heliophysics Division Director

5:30 Adjourn